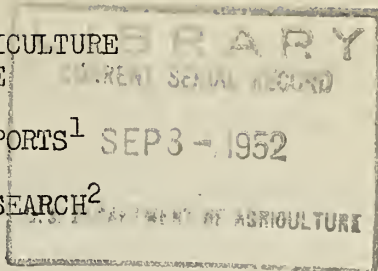


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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



SUMMARY REVIEW OF MONTHLY REPORTS¹ SEP 3 - 1952
FOR
SOIL CONSERVATION SERVICE--RESEARCH²
APRIL 1952

EROSION CONTROL PRACTICES DIVISION

Decomposition of the Mulches and Nitrogen Release - J. Vicente-Chandler, Rio Piedras, Puerto Rico

"Somewhat more than half of the grass and about three-quarters of the Kudzu-grass mulches decomposed during the course of the experiment (3 months). Only about 21 percent of the mulch composed entirely of Kudzu remained at the end of the experiment. Similar results were obtained from a Kudzu-mulched area on a nearby cliff terrace. The high nitrogen content of the Kudzu undoubtedly helped to accelerate its decomposition.

"The percent nitrogen in the mulches did not vary much during the experiment. As the carbon content did not change much (average - 53 percent) these figures are approximately indicative of the C/N ratios. The C/N ratio for the Kudzu-grass mulches was always much narrower than for the grasses alone, although both lost nitrogen in about equal proportions to their total content. Nitrogen was evidently lost from all the mulches just about as fast as the plant tissues were broken down. The loss of nitrogen by the grass mulches at rather wide C/N ratios is contrary to the belief that little release of this nutrient occurs under these conditions. There appears to be a tendency for the Kudzu to increase and for the grasses to decrease in nitrogen content toward the end of the trial. This may only be a temporary condition or it may be due to the fact that the more resistant material in the grasses has a lower nitrogen content than that of Kudzu. The Merkergrass which had been fertilized with nitrogen shortly before it was cut to be used as a mulch decreased constantly in nitrogen content throughout the experiment. This mulch also lost a higher percent of its nitrogen during the experiment than any other and had the highest nitrogen content of all the grasses at the start of the trials.

"There was a marked difference in the amount of nitrogen lost by the different mulches. The unfertilized grasses lost the least nitrogen. The Merkergrass fertilized with nitrogen released a large quantity of this nutrient. Generally, the higher the proportion of Kudzu in the mulch the greater the amount of nitrogen is released. The comparatively lower figure for the 100 percent Kudzu mulch is explained by the fact that a high proportion of old stems and leaves were included in this mulch.

"Not all the nitrogen lost by the mulches can be considered as having been a-

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²All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

available for use by plants. However, as discussed later, there is evidence that much of it actually is released for plant use. Observations made on a nearby area also point this up rather clearly. A large plot of tobacco had been grown to the age of 1 month with no nitrogen although abundant phosphorus and potassium had been supplied. The plants were yellow in color and dwarfed. At this time a mulch composed of Kudzu which had been cut 6 weeks before and piled up nearby was applied to half the plot. The Kudzu had 2.3 percent nitrogen and a C/N ratio of 21:1. Just 10 days later the tobacco was green and growing rapidly, while that in the remaining half of the plot was unchanged in appearance. As a further check nitrogen in the form of ammonium sulphate was then applied to the unmulched tobacco and shortly afterwards all symptoms of nitrogen and deficiency disappeared.

"Evidently, Kudzu, if allowed to decompose for a time under conditions where leaching is slight, can release large quantities of N for plant growth over a short period of time when applied as a mulch. If allowed to decompose on the land while subject to leaching it apparently gives up nitrogen more or less constantly over a period of time."

Conservation Agriculture Based on Grasslands - B. H. Hendrickson, Watkinsville, Ga.

"There is increasing interest in conservation agriculture based on grasslands. Experimental plantings of pilot type on plots and in pastures are showing much promise of success. Among these the perennial Ky fescue and orchard grass sods in combination with at least three legumes, look very good. Crimson and biennial sweet clovers, and alfalfa have maintained themselves very well for several years at medium fertility levels under pasture conditions, in combination stands with fescue, which is the more competitive of the two grasses.

"Rescuegrass is attracting considerable attention particularly for topseeding on kudzu pastures to supply winter and early spring grazing. The rescuegrass-crimson clover combination is also showing up well for temporary winter pasture and seed-crop purposes.

"Oklahoma southern brome grass plantings from seed supplied by the Regional Nursery Division is showing sufficient promise to warrant new trials of this perennial in different legume combinations."

Stubble Mulch - C. J. Whitfield, Amarillo, Tex.

"Soil moisture and nitrates were measured on April 28 on the wheat on fallow plots of the stubble-mulch project. These plots had produced a small crop in 1948 and no crop in 1950 so that residue has been almost entirely lacking for some time. Previous observations, that the type of tillage makes little difference in moisture conservation where residue is lacking, were born out again since the one-wayed, delayed subtilled and subtilled plots had 4.2, 4.5, and 4.1 inches of available water, respectively, in the top 4 feet of soil. The one-wayed plots, as is usually the case, showed the largest total amount of nitrate-nitrogen for the 4-foot depth of soil taken as a whole. The subtilled plots, however, had the greatest amount of nitrates in the top foot of soil. This would indicate that at some time in the past, since the last crop was raised, the one-wayed plots had higher nitrification rates. These nitrates have since been leached down and now the subtilled plots have higher nitrification rates. The great amount of available nitrogen percent in these plots becomes more impressive when the fact is considered that a bushel of wheat contains about 1.2 pounds of nitrogen and that

the available nitrogen in an acre of soil from these plots is equivalent to the nitrogen in from 195 to 235 bushels of wheat.

"It would appear that the usual situation of more available water but less available nitrogen in the subtilled as compared to one-wayed land has not prevailed in the spring of 1952, considering the shallow rooting system of the wheat. It will be interesting to note the effect on yields."

Soil Erosion Control Practices - D. D. Smith, Columbia, Mo.

"Laboratory analyses of the hay and pasture swards collected on alta fescue winter pasture at two times during the winter were completed. Some of these have been reported previously, but a complete summary follows:

<u>Date sampled</u>	<u>Yield</u> Tons/acre	<u>Crude protein</u> Percent	<u>Notes</u>
<u>Pasture Sward:</u>			
Nov. 29, 1951	1.41	11.1	This sample was from the section with Ladino clover.
Nov. 29, 1951	1.24	10.4	This sample from section without Ladino clover.
Jan. 16, 1952	not determined	9.9	Sample from entire plot.
<u>Hay:</u>			
Mar. 13, 1952	1.65	6.4	Harvested July 19-31, 1951.

"This 5-acre plot has had sufficiency-level treatments of lime, phosphate, and potash and receives 100 pounds of ammonium nitrate spring and fall. Thirteen head of coming-2-year-olds were on the area from December 5, 1951, to March 11, 1952. They lost an average of 9 pounds per head for this period, with wide variations between animals.

"Grazing was started April 1 on Kentucky bluegrass which has had ample mineral treatment and receives 100 pounds of 33-0-0 spring and fall. This was 15 days earlier than Kentucky bluegrass with Ladino clover and Korean lespedeza."

Field Traffic Intensity Studies - G. D. Brill, New Brunswick, N. J.

"The possibility of reducing traffic on potato soils is being explored by experiments begun in 1951. Traffic is not confined to highways. Farm soils, on which row crops are grown, also carry their share. A tractor with its load (plow, cultivator, sprayer, or harvester) makes approximately 20 trips at 6-foot intervals across a potato field in a year. The annual distance driven on each acre is about 20 miles.

"The problem of traffic on intensively cultivated soils is a tremendous one. Much more work needs to be done to see if the resulting destruction to soil can be lessened.

"This report deals with single year results on potato plots established in 1951 to determine the effects of cultivations and sprayer traffic on soil physical properties and on resulting yields of potatoes.

"Sprayer traffic or several cultivations resulted in compaction as indicated

by air space and volume weights. This would be expected to result in increased runoff with consequent loss of moisture for the crop, and in erosion in many cases. An interesting result, was that aggregation was not significantly affected by traffic.

"Effects of the traffic on yields were spectacular and point to the economic returns to be expected where traffic can be decreased. Reducing cultivation from five times to one gave a potato yield increase of 44 percent. Potatoes undisturbed by sprayer traffic yielded 30 percent more than those through which the sprayer ran.

"These two effects are additive. Potatoes cultivated once from which sprayer traffic was eliminated yielded 81 percent more potatoes than those cultivated five times and disturbed by sprayer traffic."

Portable Wind Tunnel Tests in Eastern New Mexico - A. W. Zingg, Manhattan, Kans.

"A major activity for the month was the carrying out of portable wind tunnel tests in eastern New Mexico. A majority of the tests were made in Roosevelt County, headquartering at Portales. Nineteen fields were selected for detailed study with a range in soil textures varying from 60 to 95 percent sand. These fields were farmer-operated. Since sorghum is the major crop, only fields in sorghum residue were tested. The fields provide a rather wide range of residue conditions in addition to the variable of soil structure. Soil losses obtained with the portable tunnel ranged downward from 230 T/A to approximately one T/A.

"These field tests were carried out with the cooperation and active assistance of personnel from the local district, the New Mexico State, and the Region VI, Soil Conservation Service offices. In addition, a representative of the New Mexico State college participated in the field work. Considerable information is at hand for the preparation of a rather detailed report on the features of the wind erosion problem in the area."

Variations in Quality of Oats Produced in 1949 under Uniform Treatment - C. E. Bay, LaCrosse, Wis.

"A portion of the plots at Madison have been under uniform treatment for 3 years to determine inherent variations in plots as determined by soil and water losses, crop yields, and quality of crops produced. Previous reports have included data showing variations in soil and water losses and crop yields. This report is on variations in quality of oats produced in 1949 under uniform treatment.

"The following trends may be noted in the protein analysis of oats samples collected in the uniformity trial in the rotation-runoff experiment on the Gugel farm near Madison, Wis.

1. Differences within and between plots and blocks are not great.
2. Past treatment has influenced protein content more than soil type.
3. The highest protein content was in oats following alfalfa-bromegrass sod.
4. The average oat yield ranged from 162 to 334 grams per sample area while the protein content of these same samples ranged from 13.2 to 15.2 percent."

Soil Erosion Control Practices - R. M. Smith, Temple, Tex.

Cattle Gains as a Result of Soil Erosion Control Practices - "Our 52 Angus steers weighed 692 pounds per head and our 52 Herefords, 666 pounds on May 1. Gains for the month were 2.48 and 2.19 pounds per head per day, respectively. All steers on small grain with clover averaged 3 pounds of gain daily. On native meadow the average was 2.33 pounds, and on permanent grasses with weeds it was slightly below 2.0 pounds. Poorest gains were made by steers on permanent grass which spent the previous month on small grain with clover. They gained about 1.0 pound per day.

"All steers were placed on small grain with clover for the month of May except for 6 steers on native meadow and 14 on fescue with alfalfa, clover, and weeds.

"It now appears certain that the all-time high of 240 pounds of steer gain per acre from small grain with clover will be exceeded this year. One 5-acre field of #90 oats with Mustang oats and Madrid clover has already produced 234 pounds. Other fields are close behind. These values do not appear to represent the maximum that can be expected from good management in the future.

"A significant part of the cattle gains during April was obtained from so-called minor species and weeds. In the fescue-legume waterway, for example, the steers ate and helped to clean up considerable cranesbill, sow thistle, false dandelion, giant ragweed, and Johnsongrass. They left most of the sun flowers. In the KR bluestem pasture, on eroded soil, the main minor species eaten were bladderpod, bur clover, button clover, rescue grass, wild vetch, milk vetch, false dandelion, sow thistle, two species of primrose, horsemint, little wild barley, and Johnsongrass. The KR bluestem was growing and was being eaten readily when the steers were pulled off at the end of the month.

"Texas wintergrass, rescue grass, and little wild barley have headed out and have passed their prime in the Bermudagrass waterway pasture as well as elsewhere. Good gains until now have been obtained from these minor species more than from the Bermudagrass."

Chicken Manure Effect - "Microbial counts for soil samples from nearby Zabcikville fertility plots, together with nitrates suggest that the effect of chicken manure is still present after 14 years. The microbes and nitrates are both high at this location. Microbial counts suggest that in profile I the 12- to 15-inch depth may be the tightest layer whereas with profile II it is probably the 4- to 10-inch depth. This checks with field descriptions which revealed a plow pan at 4 to 10 inches in profile II, but none in profile I. More such counts are needed to reveal whether dense or inactive layers can be consistently located or confirmed by this means."

Pressure Plate Equipment - "Our pressure plate equipment has been put into operation for determining various soil-moisture retention values, especially wilting percentages (about pF 4.2). By subtracting wilting percentages from moisture equivalents (about pF 2.7), some indications have been obtained of permanent available water capacities for some of our clay soils. The values so far vary within a comparatively narrow range, from 8.4 percent to 14.2 percent. The maximum obtained is for a sample from native meadow which is quite high in total organic matter, and in which the 1 gram aggregates are quite stable against slaking,

soaking, and water-drop impact."

Core Results from Crop Rotation Plots - "Some interesting results have been obtained with cores from crop rotation plots (Project 719), as follows:

Core locations	Average results from five replicate cores -					Percent moisture at saturation
	Strokes to sink cylinder	Hours to saturate cores	Volume weight	Drainage by 60	Equili-	
				cm tension	15 min	
<hr/>						
				Percent by volume		
Newly seeded alfalfa						
In wheel tracts	64	53	1.03	4.0	14.0	57.9
Between tracts	48	15	.94	7.4	25.3	63.3
Vigorous oats	14	9	1.04	16.0	24.9	63.5

"It is clear that the tractor wheel caused appreciable compaction. The oat plot drained well and showed high moisture capacity. Oat roots were abundant and appeared to influence the pore space pattern. Slowness to saturate is evident with the compacted soil, as well as more resistance to penetration by the sampling tool."

Mulch Balk - T. L. Copley, Raleigh, N. C.

"The mulch-balk treatment with tobacco continues to look satisfactory. Following rye winter cover the row areas were prepared as early in the spring as weather would permit and no difficulty is being experienced this year with rye growth along the row area. The strip of rye along the balk middle was left to grow to maturity and the tobacco rows prepared in between.

"A new method of developing the strip of rye for the mulch balk is being tried informally on a non-experimental area of the station farm. Following 1951 wheat, rows of rye were seeded 4 feet apart in October. This was done with a grain drill by stopping up five drill spouts, leaving the sixth open to drill rows of rye. This spring the tobacco row area between the rows of rye were ripped and bedded in preparation for fertilizer and planting. Considerable residue from the wheat crop and volunteer summer vegetation was worked into the land along the tobacco rows. These single drill rows of rye have made excellent growth during the winter and spring and appear to be adequate for the residue needed at layby time. Alongside these rows of rye other rows of spring oats were seeded as a trial of a different method and another type of residue. This row seeding of rye for the mulch balk seems to have certain advantages over solid seeding in that it leaves the row area clean for easy land preparation in the spring. The single rows of rye make rather thick growth with heavy stooling and it is apparent that it will provide adequate residue material.

Long-time Economic Results of Conservation Farming - E. L. Sauer, Urbana, Ill.

"A summary of 10 years of data on 80 high-and 80 low-conservation farms in Illinois shows increased earnings on the high-conservation farms resulted from the adoption of soil conservation and fertility improvement practices and from

the improvement of the general level of the management of the farm. At 1945 prices, the 10-year average increases in earnings from the high-conservation farms compared to the low-conservation farms average \$6.05 an acre. Capitalizing this increased income at 5 percent, the value of the land on the high-conservation farms would be increased by \$121.00.

"Results of 16 years of research show that conservation farming not only protects soil and water resources, but also increases farm production and income. Although some conservation measures increase production the first year, conservation plans do not necessarily increase earnings immediately. Often a considerable amount of effort and money must be expended before positive results are achieved. If the land has been poorly handled in the past, several years may be required to restore its productivity and earning power to a satisfactory level. The long-time benefits of conservation are certain, however."

Infiltrometer (Rainfall Applicator) - G. M. Horner, Pullman, Wash.

"Construction and the preliminary testing of an infiltrometer (rainfall applicator) have been completed. All of the equipment, including the wind shield, is mounted on a trailer so that the unit is portable and can be set up for operation very quickly and easily. Infiltration measurements will be made on a plot 2 feet by 3 feet with a wetted border of about 1-1/2 feet wide on each side. Two type-F nozzles are mounted on the up-slope side of the plot. One or both nozzles can be operated so as to permit a change in rates of water application. An important feature of the nozzle mounting is a mechanism for imparting a rotary motion to the nozzles. By having the top of nozzles inclined away from the axis of rotation, this mechanism results in the distribution of water to all parts of the plot at a very uniform rate of application. The rate of application can be adjusted from about 0.4 to 2.0 inches per hour. Higher rates could be obtained by installing additional nozzles."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio

"Some field experience was acquired using a set of 10-inch sweeps attached 5 inches below a 2-bottom plow. The objective was to till sod areas for mulch corn by skim plowing with the conventional 2-bottom plows and to lift and loosen the soil below to a total depth of 7 or 8 inches. Using a wheel-depth gage, fairly accurate depth control 3" + 1" was obtained. The soil appeared to loosen satisfactorily but the thin sod slice was not completely cut off, nor was it completely inverted. Some improvement is necessary in this operation.

"In handling our first cutting of hay this year, it will be possible to put some long hay into a field stack silo - loaf form. As there is considerable interest in the possible use of long grass stacks of silage, the Ohio Agricultural Experiment Station plans to make some studies on our stacks. We will cooperate in this endeavor. As farmers are urged to produce bigger and better hay crops, it appears that they are having more and more years when field curing is unsatisfactory because of the weather and of the heavy stands. There seems to be a definite need for a method of preserving the best of the hay value from time to time by silage without the investment of funds in a tower silo and in the purchase or rental of forage harvesters and blowers.

"Mr. Dreibelbis reports that the losses of N mineral by leaching in 1951 were heaviest in the crop-rotation lysimeter and lighter in the permanent-grass lysimeters. These data are given in the following table:"

Table 1.--Plant nutrients in lysimeter percolates for 1951
Expressed in lbs per acre per year

Lysimeter	Land use	Practice	Ca	Mg	K	N	Mn	S
101AB	Grass	Poor	10.81	4.86	5.65	0.18	0.20	14.13
101CD	Grass	Conservation	22.10	9.11	7.99	.22	.38	34.88
102ABC	Meadow	Conservation	18.13	18.08	7.89	7.06	.56	29.75
103AB	Meadow	Conservation	29.91	20.15	9.50	8.50	.65	55.23
103CD	Meadow	Poor	11.71	9.59	9.98	5.00	.62	28.11

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Tex.

"Field capacity in moisture down to a depth of 60 inches was reached for the first time since June 1949 on the Y area on which conservation measures are applied. The percentages of moisture at the designated depths from samples taken on April 24 from the Y and W areas were as follows:

Conservation practices - Y area: 0-6 inches, 35.9 percent; 6-12 inches, 33.7 percent; 12-24 inches, 31.8 percent; 24-36 inches, 30.3 percent; 36-48 inches, 31.0 percent; and 48-60 inches, 30.9 percent

Ordinary practices - W area: 0-6 inches, 31.8 percent; 6-12 inches, 31.6 percent; 12-24 inches, 31.1 percent; 24-36 inches, 29.8 percent; 36-48 inches, 28.3 percent; and 48-60 inches, 27.7 percent.

"There was some ground-water accumulation during the rains of April 19 to 22 at TW-11 in the cotton area of watershed Y-8. In this well 16 feet deep and which was dry prior to the rains, the water elevation rose to 6.0 feet from the surface by 1:45 p. m., April 23 and to a maximum depth of 5.7 feet from the surface by 2:30 p. m., April 24. The fall of the water elevation continued the remainder of the month and by 1:30 p. m., May 6 was at 10.1 feet from the ground surface."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebr.

"A legume mixture of 10 pounds of Patridge Pea, 5 pounds of Annual Sweet Clover, and 5 pounds of Bi-annual Sweet Clover per acre was seeded on the seven 4-acre wheat watersheds on April 3-4. This is the 3d year that legumes have been seeded in the wheat on the small watersheds in the early spring resulting in increased yields due to the added nitrogen in the soil and completes the first rotation cycle.

"Farming operations consisting of planting oats and preparing the land for corn proceeded on schedule. The wheat is in good condition and there are prospects

for a bumper wheat crop this year because of the favorable moisture conditions. Several farmers in the area applied commercial fertilizer and their wheat looks especially good. We should, however, obtain equal or better results in having a legume in our rotation.

"The waterways on watershed W-5 which is being placed in conservation practices show varying degrees of satisfaction. Waterways where several varieties of grass were planted look especially good. Three of the waterways where a single grass was seeded are in poor condition and many small gullies have been formed. Commercial fertilizer was applied to all the waterways in April."

Hydrologic Studies - R. B. Hickok, Lafayette, Ind.

"Rainfall was recorded 8 days during April, totaling about 30 percent above 'normal.' There were 2 days with precipitation exceeding an inch, including 1.61 inches on April 23. Runoff occurred mainly from 'prevailing' treated watersheds in wheat, meadow, and pasture. There was scarcely any from watersheds with corn stalk cover which had been disked preparatory to plowing for soybeans.

"Three years' comparable soil loss data for corn and soybeans have been obtained, so far. The 3 years have included only seven storms producing substantial soil losses from either or both corn and soybeans. The crop period and individual storm period losses are respectively given in the following tables:

Table 1.--Comparison of erosion losses under soybeans and corn for years when both were grown
Purdue--Throckmorton Farm, Lafayette, Ind.

Data are for crop-periods,¹ lbs./acre

Crop	Type of management	1947	1950	1951	Mean
Corn	Prevailing	2,178	11,049	5,516	
		2,958	19,481	4,566	
		Av. 2,564	15,265	5,041	7,623
	Conservation	116	2,935	108	
		524	5,050	68	
		Av. 1,335	3,992	1,88	1,472
Difference	2,229	11,273	4,953	6,151	
Soybeans	Prevailing	2,302	12,855	4,680	
		5,474	15,053	5,148	
		Av. 3,888	13,954	4,914	7,585
	Conservation	1,085	7,897	350	
		1,980	6,353	1,766	
		Av. 1,532	7,125	1,058	3,238
Difference	2,356	6,829	3,856	4,347	

¹ Seedbed preparation to harvest.

Table 2.--Soil losses under corn and soybeans for storms producing over 600 pounds per acre from any watershed, during years when both crops were grown, Purdue-Throckmorton Farm, Lafayette, Ind.

1947
CORN

Prevailing treated watersheds			Conservation treated watersheds	
			Lbs./Acre	
	Wsd. 4	Wsd. 12	Wsd. 2	Wsd. 11
6-7,8	554	2,396	137	516
8 - 2	830	379	9	8
SOYBEANS				
	Wsd. 5	Wsd. 8	Wsd. 6	Wsd. 7
6-7,8	956	3,908	1,067	1,504
8 - 2	820	896	18	379
1950				
CORN				
	Wsd. 5	Wsd. 8	Wsd. 6	Wsd. 7
6-16,19	4,682	6,557	770	1,527
6- 24	5,926	11,642	2,061	3,490
7 - 19	9	364	0	0
SOYBEANS				
	Wsd. 10	Wsd. 15	Wsd. 14	Wsd. 18
6-16,19	*5,198	*6,616	*2,881	*3,280
6 - 24	*5,160	*4,917	*2,503	*3,769
7 - 19	1,129	2,132	83	53
1951				
CORN				
	Wsd. 4	Wsd. 12	Wsd. 2	Wsd. 11
6 - 17	2,700	1,010	106	60
7 - 9	2,764	3,410	2	8
SOYBEANS				
	Wsd. 5	Wsd. 8	Wsd. 6	Wsd. 7
6 - 17	1,400	1,590	40	655
7 - 9	3,280	*3,236	310	*1,074

*Not recently cultivated.

"So far, there is no significant difference between the soil losses for beans and corn under the 'prevailing' type system of management. However, 4 years' comparison between losses from beans under the 'prevailing' and a conservation type of management, and 9 years for corn, indicate a somewhat greater effectiveness of the conservation system in reducing the soil losses under corn than under beans.

"An interesting point noted from study of the individual storm data for cases when part of the watersheds had been recently cultivated and part not, is that while recent cultivation substantially reduced the runoff, erodibility was

increased to produce practically the same soil losses as from watersheds not recently cultivated. This point was discussed in detail in the monthly report for July 1951 in regard to the storm of July 1.

"Beans in this experiment have been drilled in rows 40 inches apart and cultivated, the same as the corn. The essential differences between the 'prevailing' and conservation treatments is, respectively, contour vs. straight rows and residual effects of heavier fertilization of other crops in the rotation (no fertilization of beans in either case)."

Hydrologic Studies - G. A. Crabb, Jr., East Lansing, Mich.

"During the month, one of the rare runoffs at the wooded watershed occurred. This was the result of a 3-day local accumulation of rain totaling 2.01 inches on the recently clear-cut watershed surface. It is anticipated that clear-cutting may possibly increase the number of runoffs from this watershed. There were no concurrent runoffs from the cultivated watersheds at the time of this runoff.

"April 11, the Project Supervisor, in company with Mr. James L. Smith, Department of Forestry, Michigan State College, attended the 56th annual meeting of the Michigan Academy of Science, Arts, and Letters for the purpose of delivering a joint paper, 'A Progress Report on the Wooded Watershed.' The paper was very well received and several interesting questions were submitted to the authors during and after the program. It is proposed that this paper will be printed in the May issue of the Quarterly Bulletin of the Michigan Agricultural Experiment Station.

"On April 28 the Project Supervisor delivered the illustrated lecture, 'Research Provides a Basis for Soil and Water Conservation,' before the graduate seminar of the Soil Science Department, Michigan State College. This lecture was very well received and an intensive question period followed its delivery. It has been the experience of this project that this lecture, furnished by the Washington office of Research, makes an admirable technician's or non-technician's presentation when supplemented with local interest research slides.

"At the request of the Executive Secretary of the Michigan State Soil Conservation Committee, copies of the illustrated lecture, 'Research Provides a Basis for Soil and Water Conservation,' were made available to District Supervisors throughout the State. It is anticipated that the opportunity will be taken for project personnel to deliver this lecture to a high percentage of technical and supervisory SCS personnel in Michigan within the next few months.

"The manuscript, 'Comparative Tillage Tests at East Lansing, Michigan - A Progress Report,' written in collaboration with Dr. James Tyson, Department of Soil Science, was submitted to the editors of the Quarterly Bulletin of the Michigan Agricultural Experiment Station for publication in the May issue of the Quarterly Bulletin."

Hydrologic Studies - A. W. Cooper, Auburn, Ala.

"Wilting-point percentages and field-capacity percentages determined this month are reported in tables 1 and 2, respectively, on the next page.

"With the help of Mr. C. M. Sanders, drainage engineer, SCS Operations, the

Table 1.--Wilting point determinations of Alabama soils*

Soil type	Location county and farm	Depth inches	Wilting point 15 atmos. % (dry basis)
Ruston S.L.	Mobile - Middleton	0"-8"	2.9
		8"-22"	8.9
		22"-42"	8.9
Ruston F.S.L.	Mobile - Constantine	1"-4"	5.0
		12"-15"	7.8
		25"-28"	9.4
Norfolk L.S.	Mobile - C. B. Scott	0"-8"	2.4
		8"-22"	2.5
Norfolk Sand	Mobile - Shofner	0"-6"	1.7
		6"-40"	1.6
Carnegie F.S.L. 2gS32S	Baldwin - Louie Boum	0"-9"	5.2
		9"-22"	9.7
		22"-36"+	13.0
Irvington F.S.L.	Mobile - Constantine	0"-6"	5.6
		6"-20"	8.4
		20"-40"	7.6
Soil Unit 31	Baldwin - Benton	0"-6"	3.5
		6"-10"	4.6
		10"-24"	7.9
Leaf Silt Loam	Wilcox - Lower Coastal Plains Substation	0"-4"	21.0
		4"-24"+	29.0

*Data obtained jointly by SCS Research and Operations.

Table 2.--Field capacity determinations of Alabama soils*

Soil type	Location county and farm	Depth inches	Field capacity 1/3 atmos. % (dry basis)
Norfolk L.S.	Mobile - C. B. Scott	0"-8" 8"-22"	6.6 6.2
Soil Unit 31	Baldwin - Benton	0"-3" 6"-9" 12"-15" 20"-23"	7.9 11.2 12.3 16.2
Ruston F.S.L.	Chilton - SCS Nursery	0"-3" 4"-7" 8"-12" 18"-21"	8.6 9.2 13.6 11.9
Huntington Silt Loam	Lauderdale-J.R. Abromson	0"-3" 7"-10" 11"+	22.6 23.1 24.2
Greenville F.S.L.	Mobile - Constantine	1"-4" 12"-15" 24"-27"	9.6 13.6 13.3
Sumter Clay	Dallas - Caley	1"-4" 10"-13" 19"-22"	27.8 28.6 29.2
Potato	Baldwin - Hartung & Burimester	0"-3" 13"-16" 21"-24"	15.3 13.1 13.8
Plummer	Baldwin - Andrew Benton	0"-3" 13"-16" 20"-23"	8.9 7.4 6.3
Melvin Silt Loam	Lauderdale-J.R. Abromson	0"-3" 8"-11" 18"-21"	27.8 22.5 23.1
Ruston Loamy Sand	Baldwin - W. M. Barner	0"-3" 12"-15" 20"-23"	6.8 6.3 6.3
Ruston S.L.	Mobile - A. J. Middleton	0"-3" 11"-14" 26"-29"	9.9 12.7 12.7

*Data obtained jointly by SCS Research and Operations.

project personnel terraced the west half of the Agricultural Engineering Farm. Experimental water-disposal outlets were seeded on this part of the farm in November 1950. At that time the old terraces were pushed down and the field smoothed. By locating all outlets in the draws and leaving two irregular areas in permanent vegetations, it was possible to put in all terraces parallel. This resulted in no point rows between terraces. The entire area terraced was then planted with four-row equipment. All terraces were spaced to allow a multiple of four 40-inch rows between terrace channels and as near the spacing recommendations as possible. With very few minor exceptions, the grade in the terraces met standard specifications of having some fall but not exceeding 6 inches per 100 feet except in the first 100 feet which may have 12 inches per 100 feet. Row drainage is expected between all terraces. These terraces, as well as the outlets, will be observed carefully the next few years to determine how well they function."

Hydrologic Studies - T. W. Edminster, Blacksburg, Va.

Mr. Holtan makes the following report. "During the period of April 7-9, Mr. William A. Allaband, Engineering Specialist, Charlottesville, Va., visited the project. The entire period was used in discussion of dependability of surface runoff as supplies to farm ponds, the subsequent size of pond needed to dependably supply various requirements, the spillway design for various size ponds on various size watersheds, and the treatment of ponds in limestone areas to make them hold water. This was indeed a profitable discussion in that it pointed up very closely the problems encountered in the field in the application of Research findings. It was found that various and sundry explanations and alterations of recent publications had to be made in order to facilitate or in some cases even permit application to the field. Mr. Allaband's stated objectives and his entire attitude on the problem encourages me to believe that our farm pond situation in his area is going to improve materially."

Runoff Studies - N. E. Minshall, Madison, Wis.

"On April 22 the Project Supervisor and a representative from the University of Illinois's Department of Agricultural Engineering completed preliminary arrangements for installation of rainfall stations and a water-stage recorder on the 670-acre watershed near Edwardsville. It is planned to make this installation during the last 2 weeks in June. The measuring weir for the installation will be an existing box inlet drop spillway.

"On April 24 the Project Supervisor accompanied Work Group Engineer M. H. Fisher in an inspection of the area near Macomb, Ill., for the purpose of selecting locations for the study of high water marks and establishment of maximum stage gages. As a result of this inspection, it is expected that a number of maximum stage gages will be installed during the summer months above existing notch spillway structures. The soils in the Macomb area are of the same general type as the Fennimore watersheds, but the topography is considerably flatter. This flat topography results in more intensive farming than is the case in the Fennimore area."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.

"Work on a report covering the closed conduit spillway tests was resumed April 15 after having been dormant since December because of the pressure of other work. Part I of this report, which had been written in December, was reviewed and revised. Computations for Part II of the report were initiated, and writing of this part was begun. Part II will cover the tests made on pipe culverts having

pipe risers of the same diameter as the barrel and a bell entrance to the riser.

"Mr. Donnelly made tests during the month to determine the tailwater depth required for the straight drop spillway outlet structure. Heads over the spillway were varied from 2 feet to 6 feet, and the drop through the spillway was varied from 3 feet to 12 feet. Except for minor changes, these tests checked the tailwater-depth curve that was drawn some time ago.

"Tests were initiated to see what effect the width of the stilling basin would have on the design formulas. Widths of stilling basin were varied from 6 feet to 24 feet. For the 6-foot wide basin the width was so narrow that there was not room enough to accommodate the longitudinal sills that had been thought necessary; however, the basin worked very nicely. For the widest basin tested, Mr. Donnelly found that the floor blocks should be made wider than we had previously been using. When these wider blocks were used, the longitudinal sills were found to be unnecessary.

"Tests are now being made to study the width of the floor blocks and their spacing, and to determine a proportion of the basin width that they should occupy.

"There has been a considerable demand for the release of information concerning the performance of closed conduit spillways. For this reason, a paper entitled 'Hydraulic Fundamentals of Closed Conduit Spillways on Steep Slopes' was prepared and will be presented before the American Society of Civil Engineers at Denver on June 19."

Hydraulic Studies - W. O. Ree, Stillwater, Okla.

"Three papers were prepared. These papers are:

1. Hydraulic Tests of a Pipe Outlet Spillway.
2. The Hydraulics of Conservation Structures.
3. The Use of Grass for Waterway Linings.

"The report on the Pipe Outlet covers the experiments made on a full size replica of a pipe outlet spillway. This structure includes about 330 feet of 24-inch diameter pipe operating under a total head of 24 feet. The first 108 feet of pipe are concrete and the balance is corrugated. The two lengths are joined by a corrugated pipe elbow of 84° deflection. Different entrance structures were tested including straight inlets and drop inlets. A few of the findings will be summarized here:

1. The pipe flowed full for the maximum head and for an appreciable range below.
2. Leakage is large at the joints unless great care is exercised in construction.
3. Vibration did not occur during flows when 'gulping' of air took place.
4. Vortices formed about the intake for all entrance structures. It is believed that a weak to moderately strong vortex can mean a 2 to 5 percent reduction in flow capacity. A strong vortex indicates an 8 percent reduction.

5. For full pipe flow the following coefficients were obtained:
 - a. friction coefficient for 24-inch diameter concrete culvert pipe, 0.0201.
 - b. friction coefficient for 24-inch diameter, paved invert, corrugated pipe- 0.0742.
 - c. entrance coefficient, straight inlet, pipe groove - 0.33.
 - d. entrance coefficient, straight inlet, rounded entrance - 0.25.
 - e. entrance coefficient, straight inlet, square edged entrance - 0.70.
 - f. the debris guard offered negligible resistance flow. However, it was clean.
 - g. the total entrance loss coefficient for the drop inlets were 0.64 for the 4-foot drop inlet and 0.55 for the 8-foot drop inlet.
 - h. the elbow coefficient was 0.82.
6. For part full flow the weir flow ratings for the various entrances were obtained.

"The paper 'The Hydraulids of Conservation Structures' was presented before the meeting of the Southwest section of the American Society of Agricultural Engineers on April 11, 1952."

Drainage Studies - J. C. Stephens, West Palm Beach, Fla.

"Plantings of *Pueraria phascoloides* (tropical Kudzu) seed were made at four locations on the Federal-control levees to test the suitability of the plant as an erosion-control measure for this area. Several different approaches were made to develop the most suitable planting method. The method finally adopted was to plow out a trench or small bench near the crest of the levee by means of a large offset 'rooter' plow mounted on the front of a bulldozer. Fertilizer, formulated at the Everglades Experiment Station, was then applied in this furrow with a hand distributor. Pulverized peat was placed in the furrow on top of the fertilizer to a depth of 2 to 4 inches. The seed was then planted with a hand-seeder at a rate of 20 to 25 seed per lineal foot and lightly covered. Extremely dry weather conditions have prevailed up to the present time and germination has been slow, and it has been necessary to water the plants by means of a watering truck every other day since planting. Germination increased after a rain on the 27th and a fair stand is now showing.

"Several meetings were held in regard to salinity control along the coastal area of the peninsular. At these meetings, the general locations of proposed salinity controls; the expected seepage losses at salinity controls; the effects of related works; and salinity problems on each canal, were discussed. These meetings were attended by the representatives of the Central and Southern Florida Flood Control District, the Dade County Engineer's office, the Corps of Engineers' District and Division offices, the U. S. Geological Survey, and the Division of Drainage and Water Control, Soil Conservation Service. At one meeting, a discussion of

the relationship of channel depth and the light factor affecting the growth of aquatic plants was reviewed. Our investigations have shown that in the deeper channels where light cannot reach the bottom, the aquatic growth is hindered. As a result, it is understood that several of the proposed drainage canals in the area will be redesigned and deepened as a control factor to reduce maintenance costs from aquatics.

"At the Everglades Experiment Station concrete crop tanks were planted with green beans on April 10. The water table is being held at 12 inches in two tanks, 24 inches in two tanks, and 18 inches in one tank. The sixth tank has sprung a leak, which is irreparable at present, apparently as a result of operating a tractor too close to it. The water table in this cracked tank fluctuates with the ground-water level.

"The water consumption of this crop is being noted, and, when the beans are mature, they will be flooded in an attempt to determine their high water tolerance. Since beans are particularly sensitive to water, some degree of kill is assured after flooding.

"The 20 battery jars used in the greenhouse studies of herbicidal control of aquatic mosses were cleaned and replanted. They will be tested when this new moss has acclimated itself. Eighty-eight additional jars were obtained during the month and will be planted with moss after they have been cleaned. The following procedure has been adopted as a standard for these jar tests. The moss planted in the battery jars will be allowed to root and acclimate itself for 1 month during which the water in the jar will be flushed at least weekly to prevent stagnation damage. Herbicides will be applied at the end of the month. The herbicides will be flushed out of the jars 48 hours after application in an attempt to compensate for water transfer and water-level fluctuation under field conditions. The effect of the herbicides will be observed for 1 month after application. During this period, the water in the jars will be flushed at least weekly to eliminate the possibility of stagnation mortality."

Drainage Studies - M. H. Gallatin, Homestead, Fla.

Mulch Plots - "With little or no rain from the first to the end of the month, readings increased rapidly to the 26th on the natural cover check pine and grass-mulched areas. Readings increased on the shavings mulched area but not so rapidly. The breakdown of the shavings materials seems to be increasing at the present time though samples collected and analyzed for nitrates show that there is little or no release from the shavings 2.6 ppm, natural cover 1.0 ppm, check 1.0 ppm, pine straw 40.0 ppm, and grass 30.6 ppm."

Moisture Studies, Sunland Grove - "On the check plots of this area there was a constant decrease in the amount of moisture available to the plants from the first of the month. On approximately the 15th the check plot had reached the wilting point. Visually the trees just before the rains on the 26th looked poor in comparison to the plots which are irrigated.

"All of our preliminary data and the results of last year's work indicate that irrigation when properly applied will increase production in limes and avocados. It is believed that most of the confusion regarding irrigation in the area has arisen because in most cases the cycles of application has been fixed and

not fluctuated to meet conditions existing in the area as low water table or high winds."

Water Control on the Deep Marl Lands of South Florida - "Due to heavy rains and unsettled weather conditions the 2,000 gpm pump was operated about 2-1/2 hours so that there would be capacity in the ditches should more rain have fallen in the area.

"Visual inspection of the crops in the area showed high losses of pole beans in the area that were not protected with ditches and dikes.

"Going over this area recently and the number of calls to this office during the month shows that marl seal ditches are being installed on several new areas. The extent of increase is not known at present. There is no question that past experience and this year's experience have definitely shown that in the area south of Florida City where there is no external drainage the control of water by dikes, ditches, and pumps is essential.

"Samples collected in the Miami area on the 4th of April 1952 show slight increases along the Tamiami canal and the Biscayne canal. None of the increases are great enough to cause damage to the crops other than beans.

"Samples collected in the Homestead area on the 3d of March 1952 show an increase in concentration in the coastal area for the Goulds, Military, and North canals. For the Goulds canal the concentration remains fairly low in the area west of the structure. For the Military canal while there has not been an increase in the area between the Military canal and Alapatah road the concentration still remains high. There has been a slight increase in the area west of Allapatah to the end of the canal. For the North canal there has been an increase in concentration for the 2 miles west of the structure. This is caused by heavy pumping of the North canal. Samples collected from a potato field and the station ground show increases. In this area the concentration was such that velvet beans could not be grown for a cover crop."

Drainage Studies - C. B. Gay, Fleming, Ga.

"All of the pasture mixtures have made excellent growth to date. The crimson clover was late in making any appreciable growth and this growth was irregular. It grew quickly in late March and would have provided heavy grazing during April. This can possibly be attributed to the wet, heavy, cold nature of the soil. In this connection it appears that the crimson clover would provide grazing later in the spring than it does on the lighter soils. The minor fertilizer elements that were applied on the crimson clover with irregular growth have not shown any effect as yet. All of the summer grasses are beginning to make good growth under the clovers. The mixture of crimson clover and white clover on the Pensacola Bahia appears to be a good practice. The crimson clover after it started its spring growth developed a very rank growth, and it looks like the white clover will continue to grow and provide grazing as well as nitrogen for the grass after the crimson clover had died down. It is interesting to note also that the white clover along with the Pensacola Bahia has survived and grown in the settled stump areas where water has stood much of the time, whereas the crimson clover did not survive. The subterranean clover growing on one of the small 1/40th-acre plots has made the best growth of any of the clovers planted on the station. During the past 2 years it has made the earliest fall growth and grew the latest into last

summer. Also, it resseeded the most uniformly which is possibly attributed to its seeding habits. The fescue and ladino clover has looked good the entire winter and is continuing to grow. It appears to be well adapted to this soil condition."

Drainage Studies - T. W. Edminster, Blacksburg, Va.

"On April 15, a permeability conference was held in Blacksburg with the following personnel in attendance: Glenn L. Fuller, Regional Soil Scientist; R. E. Devereux, State Soil Scientist, Forrest Steele, Assistant State Conservationist, Messrs. Wilson and Clay, Survey Supervisors, and all of the members of the project research staff, and Dr. S. S. Obenshain of the Department of Agronomy.

"At the conference there was a thorough discussion of the application that has been made of the soil permeability data during the past several years. Also outlined were several proposed applications of these same data. Much of the discussion was centered around the factors in the survey program which have hindered the application of data to related fields; that is, irrigation, hydrologic investigations, and drainage.

"It was pointed out that in the field of drainage poor correlation was obtained in several instances between soil permeability data and the data representing the drainage characteristics of soils. Preliminary investigation with existing data indicated that a clue as to why this poor correlation occurs might be found in an analysis of the rates at which soils 'give up' free water.

"Following this discussion, H. N. Holtan and the Drainage Engineer submitted, April 24, a proposed procedure for conducting additional laboratory tests to secure these data. It was suggested that the feasibility of modifying and continuing the tests could be considered more effectively after reviewing the data obtained from at least three permeability determinations.

"Progress on preparing the outline for the circular on the tile draining of soils underlain by quick-sand was much slower than anticipated. After carefully reviewing the answers to the questionnaire, it seemed necessary to rearrange the more or less unorganized material in accordance with the tentative outline. This proved to be a very laborious and lengthy process. It should be completed soon. The arrangement of material in this manner should facilitate not only the preparation of the first draft of the outline but also the reviews and discussions necessary to the preparation of the final draft.

"One fact becomes evident which was not noted in the preliminary review of the answers to the questionnaires. There are two distinct soil conditions that influence the tile draining of these soils. First, some of the soils appear to be underlain by a quick-sand layer in which there is some clay. While the sandy material flows freely into ditches, the finer material furnishes a reasonably firm bed on which to place tile. Second, apparently much smaller areas of soils are underlain by mucky sands. These soils furnish no bed for placing tile. Cradling is unanimously recommended under such conditions.

"The presence of numerous tree stumps located in the sand layer which has caused unlimited trouble in Virginia Coastal Plain was not mentioned in the replies from other areas."

Supplemental Irrigation in Virginia Agricultural Production - T. W. Edminister, Blacksburg, Va.

"The grazing of beef cattle was begun on the lots of the pasture irrigation experiment on May 1. Each check bluegrass lot was stocked with four head, the two irrigated bluegrass lots were stocked with six head. The four ladino lots, two of which will receive irrigation and two which will not were stocked for rotational grazing. At present four head were placed in each of the ladino areas of lots No. 1 and 2. These cattle will be rotated to the ladino areas of lots No. 3 and 4.

"The rainfall for the month was approximately 4.26 inches. No irrigation has been applied; however, the system can be operated when needed."

Sedimentation Studies - R. Woodburn, State College, Miss.

Frequency and Duration of Droughts in South Mississippi— "In discussing this question with the group at Brooksville it was pointed out that there have been many definitions of drought. The criterion used for this discussion was based upon general water needs for most crops for average south Mississippi conditions by months as computed by Dr. W. A. Raney of the Agronomy Department at State College. Three tables have been mimeographed, copies of which can be obtained from the project. For table 1, 2.50 inches (estimated available soil moisture) were subtracted from the monthly water-needs figure to arrive at the minimum rainfall needed for each month. Any month for any year of study was entered as a deficit if less than this was received.

"In table 2 the water needs figure was calculated as before except the subtraction of 2.50 inches for soil moisture was made only once--that is, at the beginning of the period of interest either May to August or May to October, inclusive.

"The drought-duration study shown in table 3 is self-explanatory except it should be mentioned that a period covered is May to October, inclusive."

Investigation of Formula Used to Estimate Pond Volume - "We were requested to study the formula used in estimating pond volume.

$$\text{Volume} = 0.4 \times \text{maximum depth} \times \text{surface area}$$

"Accordingly an examination was made of the records of our survey of 23 ponds and lakes in north Mississippi last year. In the course of this sedimentation survey area and volume were measured or calculated and many ranges or cross sections were sounded for each reservoir so maximum depth could be easily determined. In each case we divided volume by the product of surface area and maximum depth to secure the factor analogous to the 0.4 in the formula. This factor varied from 0.32 to 0.64 with an average of 0.44.

"These data are shown in the tabulation on the next page.

"It is apparent that if accuracy of pond measurement is desired or needed a proper hydrographic survey should be made. It does appear, however, that for purposes of estimating, the 0.4 factor formula is fairly satisfactory for most topographic conditions.

Reservoirs Used in Sedimentation Survey
Relationship of Surface Area, Maximum Depth, and Volume

	1	2	3	4	
Name	Area at time of survey	Maximum depth time survey	1 x 2	Volume at time of survey	4/3
Bramlett	34.61	15.1	522.61	214	0.409
L. Shahkoka	28.90	20.1	580.89	256.14	.441
L. Woodland	15.85	9.4	148.99	78.06	.524
L. Gayoso	9.56	12.8	122.36	52.99	.433
Rodman	6.69	10.3	68.91	28.97	.420
Ramsey	5.37	10.4	55.85	24.87	.445
Hurdle C. S.	5.35	13.9	74.36	28.97	.390
Dockery	4.95	9.1	45.04	21.95	.487
Patton	4.13	8.9	36.76	12.08	.329
Kyle	3.76	11.6	43.67	16.64	.381
Johnson	3.12	10.1	31.51	14.77	.469
Langston	2.45	10.4	25.48	9.66	.379
R. X. Williams	1.84	3.9	7.18	2.54	.354
C. D. Williams	1.58	9.5	15.01	6.70	.446
Humesucker	1.51	12.0	18.12	8.35	.461
Stevenson	1.40	6.6	9.24	4.23	.458
Jones	1.31	10.4	13.62	6.40	.470
F. Hurdle South	.94	8.3	7.80	3.61	.463
F. Hurdle North	.88	6.6	5.81	2.67	.459
Smith	.84	8.1	6.80	3.29	.484
Pettis	.49	3.4	1.67	1.07	.641
White	.47	7.0	3.29	1.07	.325
McAlexander	.41	5.6	2.30	1.11	.482
					10.150

Average = 0.441

"The determination of surface area is best done by stadia survey either transit or plane table but field personnel can often devise methods for doing this by tape or otherwise that should be within 5 to 10 percent of true area.

"It appears that there is no satisfactory way to estimate maximum depth except by boat and trial sounding since many ponds involve a borrow pit above the dam.

"Further attention is being given to other approximate formulac for rough approximation of pond volume if they appear to be useful for field use."

IRRIGATION ENGINEERING AND WATER CONSERVATION DIVISION

Irrigation Studies - K. Harris and B. Peterson, Phoenix, Ariz.

Cotton Planter Attachment - "In cooperation with Joel Fletcher and Verlin Chandler of the SCS Research Office in Tucson, an attachment was developed for use on a cotton planter. This attachment prepares a loose seedbed 6 inches wide in

front of the planter shoe. By using this method, it is not necessary to work the whole field but only that portion immediately in front of the planter shoe. This leaves the area between the seed rows undisturbed and should make for a better water intake rate of each subsequent irrigation. By using this attachment, it is possible to plant cotton after only rough plowing and irrigating. It is not necessary to do the ordinary intermediate steps which reduce the intake rate of water into the soil."

Infiltration Rates - "Infiltration rates were determined on the lettuce tillage tests at the University of Arizona Farm, Yuma, Ariz. Following are the infiltration rates as determined by 8-inch infiltration rings:

Treatment	Infiltration rate (Inches per hour)
A - Plow(15-18"), Furrow and Plant	0.256
B - Double Disc, Double Float, Furrow, Plant	.109
C - Plow(15-18"), Disc, Float, Plant	.221

"Infiltration rates were determined and pentrometer readings taken on the Barley Tillage Tests being conducted at the University of Arizona Farm at Yuma, Ariz. Following are the results of this test:

Treatment	Infiltration rate In./Hr.	Pentrometer readings
1. Plow, plant, irrigate	0.35	35.0
2. Plow, Disc, Float, irrigate, disc, plant	.09	46.0
3. Plow, irrigate, harrow, disc, plant	.07	49.0
4. Plow, irrigate, float, plant	.21	42.0

"The above results show without a doubt the bad effects of tillage on the infiltration rate of water into the ground."

Irrigation Studies - H. K. Rouse, Gunnison, Colo.

"The 120-day feeding experiment being conducted by the Gunnison County Feeding Research Corporation with cooperation from this project ended April 3.

"Gains made by the animals were a straight line function of the amount of crude protein in the ration, and how this relationship could be used to evaluate the production of hays under the several factors being studied; four irrigation practices, two sods, eight fertility levels and two harvest dates - a total of 128 combinations. These evaluations indicated that the two most important factors were improved control of irrigation water and better timing of the hay harvest - both management practices which involve little or no additional cash outlay.

Predicting Alfalfa Yield - S. J. Mech, Prosser, Wash.

"Some very interesting information on the growth characteristics of alfalfa came to light during the preparation of yield data for inclusion in an alfalfa irrigation report. Because of the uniformity of alfalfa's growth or dry matter production, it appears as if it were possible to predict or compute with considerable accuracy the production of hay for the second or third cutting.

"Our yield data for 1945-47 was analyzed and is shown in table 1 and figure 1, mimeographed copies of which can be obtained from the project. The similarity of the rate of production (the slope of the curves) for all years and both varieties made the above conclusion possible.

"Another indicated conclusion is that a low first cutting means a low total annual yield, whereas a high first cutting means a high annual yield. The production between the first cutting and the third cutting was at substantially the same rate per day regardless of the magnitude of the first cutting yield.

"The yield formulas in table 1 show that the average total yield is equal to a constant plus 0.041146 times the number of days elapsed since May 15. What causes the wide range of first cutting yields is not yet known. However, it is felt that severity of the preceding winter is a factor.

"That the alfalfa made substantially the same rate of growth for a range of age varying from that seeded the preceding fall to that in its third full cutting year is quite amazing. Greater differences were expected.

"There was no difference in either the first cutting nor rate of production that can be attributed to the wet, medium, or dry treatments.

"To test this concept further, data collected at the Irrigation Experiment Station during the period 1921-26 is presented in figure 2 and table 2, mimeographed copies of which can be obtained from the project. Only the total yields were published in Washington Agricultural Experiment Station Bulletin 209 in 1926, but the individual cutting yield data were obtained from the author of the bulletin, Mr. Harold P. Singleton, Superintendent of the Irrigation Experiment Station.

"It is evident that there is a similarity in these rates of production and those of ours. Though it is generally recommended that alfalfa for hay be cut no later than 1/4 bloom stage and preferably earlier, these data on the 1/2 and 3/4 bloom show the influence of maturity on growth characteristics. It is suspected, however, that the growth processes after September 1 are slowed down considerably and this slowing down is a big factor in the reduced rate of growth for the third cutting.

"Winter temperatures (we have almost no snow cover) may have a profound influence on the size of the first cutting. The results for 1921-26 in figure 2 seem to bear this out as the winter of 1920-21 had a minimum temperature of only 14°. The other years experienced considerable zero temperatures ranging as low as -12° F. The minimum during the winter of 1925-26 was +20° F. The 1926 yield jumped considerably after a steady decline since 1921."

Hydraulics of Wells - V. E. Hansen, Logan, Utah

"The following is a synopsis of the forthcoming Agricultural Experiment Station Bulletin entitled 'Hydraulics of Wells' by Dean F. Petersen, Jr., Orson W. Israelson, and Vaughn E. Hansen:

"A brief resumé of basic equations for the hydraulics of steady-flow wells is presented. Deficiencies of existing formulas and practices are discussed and suggestions for improvement made.

"For unconfined ground-water flow into wells the existence of the seepage surface at the well and the relationship of this surface to the other elements of the well system are but little understood. Hansen developed in 1949 dimensionless parameters which enabled specific test data to be plotted in general terms. His work has been extended herein by adding the theoretical solutions made by Yang, also in 1949, using 'relaxation' methods and the unpublished data obtained by Zee, in 1951, using a combination of the electrical and membrane analogies. These solutions enable the investigator to estimate the magnitude of the seepage surface for a wide range of specific cases of unconfined flow into a well.

"Dupuit's classical solution for unconfined ground-water flow into a well is based on the assumption that all of the discharge flows horizontally into the zone of influence from outside the region under consideration. For a drainage well to relieve lands waterlogged by surface irrigation, flow enters the region of influence by vertical percolation of water falling on or applied to the overlying land surface so that the flow toward the well increases as the well is approached. A theoretical solution is presented herein for this condition. The geometry of the region of influence for this type well of radius, r_w , is the same as for a well of the Dupuit type having the same drawdown but with a transformed radius, r_w' , equal to $r_w \cdot n^{1/2}$ in which n is the ratio of the discharge of the well. With this transformation, the seepage surface for the unconfined, vertically recharged well may be found by using the same curves as are used for the horizontally recharged well.

"Critical evaluation of the commonly used formulas for confined and unconfined ground-water flow into wells leads to the conclusion that they are indeterminate. They are made determinate in practice by introducing the radius of influence, r_c , usually as an arbitrary value, a concept which is somewhat vague at best, if not illogical.

"The variables in these formulas include the soil permeability k , the drawdown D_w , the thickness of water-bearing material, T , the radius of the well, r_w , the discharge, Q , and the radius of influence, r_c . The independent variables are D_w , k , T , and r_w ; Q and r_c are dependent and mutually interdependent. An additional independent variable, q , describing the unit rate at which the influence cone is replenished with water from an external source, is necessary to complete the analysis. These five independent variables are sufficient to fully determine the flow into a well for any particular system.

"The discharge of the well may be expressed in the dimensionless form, $\frac{Q}{kr_w^2}$, called the 'Discharge number.' Dimensional analysis shows that the discharge number is functionally related to the dimensionless quantities $\frac{D}{r_w}$, $\frac{T}{r_w}$, $\frac{q}{k}$. By introducing certain approximations specific functional relationships between

these quantities are developed for particular types of well systems. The quantity Q/k_r^2 is of special significance since, as V. E. Hansen has shown, it equals the ratio of the Froude and Reynolds numbers and therefore expresses the relative importance of the viscous and gravity forces. The discharge number also describes, in relative terms, the geometry of the flow in the medium surrounding the well.

"Seven illustrative numerical examples are given. Dimensionless quantities presented herein may be used for any system of units providing the same system is used throughout.

"Care must be used in calculating the 'effectiveness' as defined by Wenzel (1942) for wells in unconfined flow systems or values much too small will result. If the piezometric head is measured at the bottom of the permeable stratum, instead of at the water table, reasonable results may be expected. Normal procedure results in considering the head represented by the height of the seepage face as lost head, so that wells in unconfined systems normally appear to be somewhat less effective than similar wells in confined systems. Actually, other things being equivalent, as shown in equation 51 and the accompanying discussion, a well in an unconfined system is inherently somewhat more efficient in utilizing available energy than a similar well in a confined system."

Snow Surveys - H. J. Stockwell, Ft. Collins, Colo.; and M. W. Nelson, Boise, Idaho

Colorado - "April 1 snow-water contents on practically all the snow courses in this area were at a record high for any date since snow surveys were started in 1936. With the exception of the Rio Grande and tributaries in New Mexico the summer runoff of most streams will be at or near record highs in this area. Local flooding may be expected, particularly on the Rio Grande in Colorado, in extreme northern New Mexico and on tributaries to the Colorado River in southwestern Colorado."

Idaho - "High water and flooding have already occurred in several of the smaller tributaries to the Columbia River. Much additional damage would have occurred had not the reservoirs been operated to take care of abnormally heavy flows."

Drainage Investigations - W. D. Criddle, Boise, Idaho

"During April, George D. Bradshaw spent a full week with Operations work group in Skagit County, Wash. The purpose of the meeting was to acquaint the local Operations staff with the drainage tools and equipment that we use and to assist in setting up procedures for determining the proper spacing of tile-drainage laterals in the major soil types in Skagit County.

"The following equipment was demonstrated and used during the week:

1. Salinity bridge.
2. Alkali testing kit.
3. Thief tubes for obtaining ground-water samples.
4. Piezometric equipment.
5. Permeameter equipment.
6. Electrical plumbing devices and sounding bells for reading water levels in wells and piezometers.
7. Tile effluent measuring equipment.

"The following procedure was developed for attacking the drainage problem in Skagit County:

1. Initiate not more than two drawdown studies on the three major soil types requiring drainage.
 - a. One wide and one narrow tile spacing.
 - b. Or to bracket a varied tile spacing on each soil type.
2. Investigations for each site.
 - a. Install a line of shallow piezometers or wells transversing the drainage system.
 - b. Check existing soils data with additional auger holes.
 - c. Check the rainfall on each plot with a standard or improvised rain gage.
 - d. Measure the tile-drainage discharge at each site with the tile stick.
3. Sufficient differential length piezometers should be installed to determine any vertical movement of ground water at each test site.

"In addition to checking existing drainage systems, a long-time study should be initiated to improve the drainage design and to sell this better design to the farmers. The permeability of the major soils should be checked with the falling head permeameter from open ditches and tile-machine cuts to build up a series of permeabilities for each soil type. These individual permeabilities will be used to obtain an over-all prorated field permeability for tile-spacing design.

"Sufficient tile-drainage discharges should be measured during the critical drainage period to determine the amount of water that has to be drained from the various soil types.

"Plotting the rainfall pattern for a number of years will be very useful in determining if the observations are being made during a normal or an abnormal year.

"Pictures taken before and after drainage along with crop-production increases and fertilizer applications will prove very useful in selling the drainage program.

"A form was developed in cooperation with the Idaho soils men on which to inventory the soil permeability necessary for drainage-design purposes. All SCS technicians doing drainage work in the State will use this standard form so that a general interpretation can be made."

Infiltration Studies - C. E. Johnson, Bakersfield, Calif.

"Determinations were made of the amount of water-soluble material present in cotton-gin trash. Results indicate that about 21 percent by weight of undecomposed material is water soluble. This soluble fraction may account for the initial rapid decomposition rate. Hardness determinations of gin-trash extract show that the resulting solution has increased greatly in 'hardness' as determined by the 'Versene' method. The insoluble residue remaining after extraction will be used in further decomposition studies."

Upper Santa Clara Soil Conservation District Investigation - H. F. Blaney and W. W. Donnan, Los Angeles, Calif.

"This investigation was started a few months ago at the request of Operations, SCS, and by the Directors of the Upper Santa Clara SCD for the purpose of making an inventory of the irrigation water supply and determining the present use of water; safe yield of the underground reservoirs; and the possibilities of conserving the limited water supply in the District.

"Some time was spent during April in making an analysis of rainfall and runoff records on the Upper Santa Clara watershed in cooperation with the Upper Santa Clara SCD. The long-term records of the Los Angeles County Flood Control District indicate a mean annual rainfall of 16.31 inches in this area. A 21-year record of runoff on the Santa Clara River at the USGS gaging station at U. S. Highway 99 bridge was compiled. Analysis reveals that the 21-year mean runoff was 11,900 acre-feet or about 29 acre-feet per square mile on the 410-square-mile watershed area. By comparison with runoff data from other watersheds in Southern California, this is a relatively low mean runoff per square mile for the apparent mean annual rainfall. It indicates that the watershed or the valley floor area may have high absorptive and retentive characteristics."

Mojave Desert Soil Conservation District - H. F. Blaney, Los Angeles, Calif.

"At the request of District Conservationist Arthur Darsey, a conference was held with the Directors of the Mojave Desert SCD at Holendale, San Bernardino County, to discuss water supply and irrigation problems in this recently organized District. Reports prepared by the Division of Irrigation in 1917, 1935, and 1943 on the Utilization of the Waters of the Mojave River were reviewed. An analysis was made of available data and it indicates the irrigated acreage in the Mojave River Basin has increased almost 300 percent since 1939 as shown in the following table:

Year	Irrigated area Acres	Consumptive use of water		
		Irrigation Acre-feet	Municipal Acre-feet	Native vegetation Acre-feet
1917	9,870	23,000		
1929	6,118	18,000		
1935	6,533	18,000	1,100	39,000
1939	6,456	19,368	1,200	11,500
1951	18,000	56,000	2,000	37,000

"During this 12-year period the annual consumptive use of water increased from about 32,000 acre-feet to 95,000 acre-feet. During the period 1944-51 there was a lowering of the water table and the average annual recharge has been estimated to be 48,000 acre-feet as compared with the 1951 consumptive use of 95,000 acre-feet. Thus there has been an overdraft on the water supply for irrigation and a water conservation program is needed."

Rainfall Penetration - G. M. Litz and W. T. Gish, Los Angeles, Calif

"Soil-moisture samples were taken at Rainfall Penetration Stations in Zone 3 of the Ventura County Flood Control District. The results show use of water by the thick stands of weeds and grasses to depths of 2 and 4 feet when compared with the January 23 samples. On January 23, the soils were at field capacity from heavy

rain and the weeds, etc., were small."

Farm Seepage Studies - D. W. Bloodgood, Austin, Tex.

"Seepage studies were made on the north ditch of the Winter Haven Experiment Station for a period from December 5 to February 24. This ditch is approximately 780 feet long and takes water from an earthen storage reservoir. It furnishes water for about one-half of the vegetable acreage at the station. The ditch is constructed in 647 feet of Webb fine sandy loam, surface soil of which is heavy and shallow, and 133 feet of Crystal fine sand. Probably most of the seepage loss is in the fine sand.

"During the 42-day period the total amount of water measured in the upper Parshall flume located near the reservoir was 1,595.17 acre-inches of water. At the lower Parshall flume (780 feet of ditch) for the same period the measurement was 913.35 acre-inches. The total loss between the two flumes was 681.82 acre-inches. The average seepage loss was 42.7 percent. The average percentage of daily seepage loss after the ditch had been dry for some time was 72 percent, and after the ditch had been wet for several days, it was 9 percent."

Irrigation Studies - P. E. Ross, Weslaco, Tex.

"Drought continues in the Lower Rio Grande Valley of Texas. Irrigation water has not been available during the month and water has not been plentiful for domestic purposes. Light rains on the Rio Grande River watershed late in the month helped the domestic supply; but very little, if any, water will be available for irrigation purposes until further rains occur.

"Assistance in design and lay-out of irrigation systems was given Rio Farms during the month on an 80-acre tract of land, which is to be established in citrus. The entire area will be given over to research on citrus. It was pointed out to Rio Farms that research on irrigation on citrus would necessarily be held to a minimum from our Service standpoint because of lack of funds for operating. It was felt, however, that the grades, length of runs, border areas, etc., should be designed in such a manner that research on irrigation could begin on the tract when funds will permit. For this reason, I designed the systems to be used on the groves.

"The outlying grass plots on the Garrett farm near La Paloma have received no irrigation water since March 6. Soil-moisture samples showed the moisture to be badly depleted the first of April and samples on April 29 indicate that wilting range has almost been reached for a depth of 5 feet in some of the plots. The alfalfa has suffered more than the grasses have for water and is in very bad shape at the present time. The Rhodes grass appears to be withstanding the droughty conditions better than the Harding grass, but both are badly in need of moisture."